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The principle of mutual recognition -  
A source of divergence?

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**CORE**

DISCUSSION PAPER

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**The principle of mutual recognition –  
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**Abstract**

Governments set numerous norms to protect consumers. Two countries may achieve the same level of protection of their consumers through different specifications. The adaptation costs induced by these differences create barriers to trade. The principle of mutual recognition addresses the problem by ensuring that products lawfully manufactured in one country are acceptable without adaptation in another country. We show that by shifting the transaction costs of adapting to several norms from firms to consumers the principle of mutual recognition creates disparities across countries and is (more) beneficial to larger countries.

**Keywords:** technical barriers to trade, mutual recognition, economic geography, home market effect.

**JEL Classification:** F13, F15, R12, R13

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# 1 Introduction

National norms applicable to certain products pursue general objectives such as trade fairness, consumers protection or product compatibility. For instance, norms can protect consumers against sellers who have a better information about the product that they sell. Different States can pursue the same general objectives and reach the same level of consumers protection, but in the absence of coordination, their legislation differs, yielding different norms. Therefore, a company wishing to export must adapt its product to the norms of the export market. Adaptation is expensive even if the non-adapted product gives the same level of protection to the consumers as an adapted product.

Norms are of concern to WTO as far as they can be strategically used by local governments as technical barriers to trade. We present the literature on the strategic use of norms at the end of this introduction. In this paper we adopt a different view. Norms act as barriers to trade even if they are not set strategically as such. Although numerous norms are set to protect consumers but not to restrict trade, they have a negative side-effect on trade. This problem has long been recognized by the EU, which, for many years, tried to address the costs of regulation heterogeneity by regulation harmonization. However, harmonizing regulations of a large set of countries can be extremely slow if it requires a unanimous approval by Member States (see Paul Brenton, John Sheehy and Marc Vancauteren, 2001). About 25 years ago, the European Commission addressed the problem by adopting the *principle of mutual recognition*.<sup>1</sup> In February 2009, the Committee on economic and monetary affairs of the European Parliament advocated gradually integrating the EU and US markets through mutual recognition combined with a degree of convergence of the current regulatory frameworks (European Parliament, 2009). The principle of mutual recognition ensures that *a product lawfully manufactured in one Member State is acceptable without adaptation in another Member State, provided that both legislations reach the same level of consumers protection*. Should this condition be interpreted with sufficient flexibility, the good application of the principle would reduce production and export costs, and consumers would have access to a wider range of products.

Do consumers always gain from the application of the principle of mutual recognition? The question is all the more acute that the principle could also be applied to services. As pointed out by Jacques Pelkmans (2005), it is

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<sup>1</sup>There is also a rapid spread of mutual recognition agreements between the EU and its major trading partners, within APEC and other regional arrangements, see Richard E. Baldwin (2000).

more difficult to assess the quality of a service than that of a good, which explains the numerous norms set to ensure a proper functioning of service markets. Under the principle of mutual recognition, a company that exports a product (a service or a good) has two options. Either it adapts its product to the norms of the host country, or it does not. If both countries followed the same general objectives when setting their norms, the two options offer the same broad protection to consumers. Still, it is likely that consumers prefer products delivered under a familiar set of rules to products operated under unfamiliar norms, that is, a non-adapted product provides a lower utility than an adapted product.

To illustrate the last point, consider the service provided by architects in countries A and B. To protect the buyers of this service, norms are set on several dimensions of the service: they define the responsibility of the parties in case of construction delays, the type of the after-sale service, ... Country A may grant a large after-sale service and a poor protection to consumers against delays. Country B may offer the opposite. Globally consumers benefit from the same global protection in both countries and may end up being indifferent between both sets of norms *if they perfectly knew both sets of norms*. However, consumers from A probably know the norms from A, or at least they know where they could get the information about these norms. By contrast, they are probably more ignorant of B-norms, even more so if these norms are written in a foreign language. In case of construction delays, a consumer from A, who has bought a contract operated under B-norms by application of the principle of mutual recognition, may not even think that he benefits from a good protection, which prevents him to take the full benefit of his contract. For this reason a consumer who does not know foreign norms discounts the utility of consuming a good produced exclusively under foreign norms. The alternative is that he learns norms from B, which allows him to take the full benefit of goods produced under foreign norms. However, learning is costly. As a matter of fact, the application of the principle of mutual recognition shifts the transaction costs of adapting to several norms from the firms to the consumers (Kalypso Nicolaïdis and Susanne K. Schmidt, 2007).

To assess the welfare effects of the mutual recognition principle, we use a model with monopolistic competition and two countries. On the one hand, firms reduce their costs by using the principle of mutual recognition because they are not forced to adapt their products to foreign markets. This reduction of costs promotes entry of new firms, which is beneficial to consumers who exhibit preference for variety. On the other hand, products are less adapted, which is detrimental to consumers who discount the utility of con-

suming a non-adapted product, which we define as the *adaptation discount*. We also examine how firms respond to the principle of mutual recognition by selecting their preferred rules among those offered by the two countries.

We consider two settings. In the first, we assume that consumers do not learn foreign norms. We identify a home market effect because consumers are biased towards products operated under familiar norms: firms disproportionately use the norms of the larger country because these norms are familiar to the larger population.

If the adaptation discount is small, all firms choose the norms of the larger country. For instance, cars registered in France were required to have yellow headlights since 1936, in contrast with the rest of Europe. Since the early-nineties cars equipped with white headlights, which is the norm in the rest of Europe, can be sold in France. Consumers probably have a negligible adaptation discount for headlights. Nearly all cars sold in France are nowadays equipped with white headlights.

For an intermediate adaptation discount some firms use exclusively the norms of the larger country whereas the other firms adapt their product to both legislations. Firms do not use the principle of mutual recognition if the adaptation discount is large; they prefer to adapt their product in order to keep a sufficiently large export market. A large adaptation discount is consistent the EU insurance market (Schmidt, 2002): in 1997 the market share of life and non-life insurance in Germany was smaller than one percent for non German EU companies operating under their home norms.

Consumers from the larger country always gain from the application of the principle of mutual recognition. They have access to more numerous goods, most of them using the rules of their country, either exclusively or in combination with the foreign rules. By contrast consumers from the smaller country unambiguously lose if the adaptation discount takes intermediate values: they benefit from more products but fewer are adapted to their norms, which is quite costly because of the non negligible adaptation discount. For a small adaptation discount those consumers unambiguously gain but their gain is smaller than the gains obtained in the larger country.<sup>2</sup> The application of the principle of mutual recognition improves welfare in both countries only for some parameter values and at the costs of increased disparities.

In the second setting we assume that consumers can learn foreign norms at some costs. By learning foreign norms they fully benefit from a product

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<sup>2</sup>For a large adaptation discount, firms do not use the principle of mutual recognition and adapt their products.

that has not been adapted to their national norms. We identify the following equilibria according to the adaptation discount. For a small discount, nobody learn the foreign specification and the former analysis holds. For an intermediate and a large discount, households from country A learn norms of country B; all firms use norms of country B as these are known by all consumers, and households from country B do not need to learn rules from A, which are not used. Firms use country B norms that are universally known.<sup>3</sup>

Another equilibrium exists when the adaptation discount is large: all firms adapt their product to both sets of rules and, as a result, consumers do not learn the foreign specifications. Multiple equilibria ensue for large adaptation discounts. We show that the households who do not learn foreign specifications unambiguously gain when the principle of mutual recognition is applied: more products are available and these products use their specifications. Households who learn the foreign specifications gain only if the cost of learning is small enough.

The model is quite general and applies to any good that is sold in one of the two countries, even if the good is produced in a third country that has not signed a principle of mutual recognition with the two other countries. When it sells in the two countries, the third country producer chooses its preferred norms among the norms of the two countries.

If one focusses the analysis to the producers of the two countries and if one assumes that firms must use the norms applicable in the country of production when they sell in that country, then the model identifies a new force of firms agglomeration that complements the forces analyzed in the new economic geography literature.<sup>4</sup> For large and intermediate adaptation discounts, households from a first country learn foreign rules and firms produce in the second country to use rules that are universally known. This equilibrium exists even if countries have identical sizes; moreover in case of countries of different sizes, agglomeration can take place in the smaller country. As emphasized by Baldwin (2000, p. 239), falling tariff levels, teamed with lower transportation and communication costs, “means that

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<sup>3</sup>This result is familiar in the literature on multilingualism, see Reinhard Selten and Jonathan Pool (1991), Jeffrey Church and Ian King (1993), Jean Gabszewicz et al. (2005). Agents from country A learn the language of country B if the benefit of communicating with foreign agents is large. Because agents from A are able to communicate by using the B-language, few agents from B learn the A-language.

<sup>4</sup>Paul Krugman (1991), Anthony Venables (1996), Masahisa Fujita, Krugman and Venables (1999), Fujita and Jacques F. Thisse (2002), Richard Baldwin, Rikard Forslid, Philippe Martin, Gianmarco Ottaviano and Frédéric Robert-Nicoud (2003).

even a slight tilt tends to have large effects on the location of production. In particular, seemingly minor differences in technical norms can have an outsized effect on production.”

To the best of our knowledge this is the first theoretical model that analyses the effects of the mutual recognition principle on welfare and on firms location when norms are not set strategically. In the related literature, Arnaud Costinot (2008) considers standards set up to cope with environmental externalities (vertical standards) and product compatibility (horizontal standards). In a two firms, two countries model he examines how standards are strategically set under the mutual recognition principle and under the national treatment principle. He shows that standards are imposed for levels of externalities that are too high under the mutual recognition principle. Other papers emphasize how protectionist incentives interfere with the setting of norms; see Ronald Fischer and Pablo Serra (2000), Kyle Bagwell and Robert W. Staiger (2001), Neil Gandal and Oz Shy (2001), Akiko Suwa-Eisenmann and Thierry Verdier (2002), Mikhail M. Klimenko (2009).

Empirical estimations by Silja Baller (2007) show that mutual recognition agreements have a strong positive influence on both export probabilities and trade volumes for partner countries. Maggie X. Chen and Aaditya Mattoo (2008) also show that such agreements are promoting trade. Roland de Bruijn, Henk Kox and Arjan Lejour (2008) use an applied general equilibrium model of the world economy to assess the performance of an EU proposal to fully extend the principle of mutual recognition to services. They show that a full implementation of the proposal would increase GDP of the EU by 0.3-0.6%, while consumption growth would be between 0.7 and 1.2%.

The rest of the paper is organized as follows. Next section sets up the model with agents preferences, their decision to learn foreign rules, and firms behavior in terms of prices and output. Sections 3 and 4 examine the equilibrium choice of rules, respectively under the assumptions that households cannot learn foreign rules and that they are able to learn them. This discussion is followed by the conclusion.

## 2 The model

The model builds on Avinash K. Dixit and Joseph E. Stiglitz (1977) with two countries,  $r$  and  $s$ . The population in country  $k \in \{r, s\}$  is equal to  $L_k$ . Without loss of generality, we suppose that  $L_r \geq L_s$ . We consider an increasing returns to scale sector that uses a single input to produce differentiated varieties. There is a fixed cost and the marginal cost is normalized

to one. Free entry determines the mass of varieties that are produced.

## 2.1 Preferences

Free entry determines the mass of firms  $N$ . Each firm produces a differentiated variety  $i \in [0, N]$  that is designed to the specifications of at least one country, which we call the home country. In the absence of mutual recognition firms must adapt their product to the specifications of the other country in order to export. This adaptation is costly but it allows all consumers to take the full benefit from these products. In case of mutual recognition, firms are allowed to sell their product to the foreign country with or without adaptation to the foreign specifications. However foreign consumers do not fully benefit from non-adapted products. Still, a consumer may costly learn the foreign specifications, which allows her to take the full benefit from consuming foreign non-adapted varieties.

A consumer of country  $k$  ( $k \in \{r, s\}$ ) who has not learned foreign specifications has the following preferences:

$$U_k = \left( \int_0^{n_k} (C_k(i))^{\frac{\sigma-1}{\sigma}} di + \int_{n_k}^{n_k+n_a} (C_a(i))^{\frac{\sigma-1}{\sigma}} di + \int_{n_k+n_a}^N (\phi C_l(i))^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

where  $l \in \{r, s\}$  and  $l \neq k$ . The parameter  $\sigma > 1$  denotes the elasticity of substitution between varieties. The variable  $n_k$  denotes the mass of firms that use exclusively the norms from  $k$ ,  $n_a$  is the mass of firms that adapt their variety to both countries.  $C_k(i)$  is the consumption of a variety  $i$  that is designed for the only specifications of country  $k$ .  $C_a(i)$  is the consumption of a variety that has been adapted to the specifications of both countries.

*In case of mutual recognition*, a household can consume a non adapted variety. However the household does not fully benefit from the variety if she has not learned the foreign specifications; she discounts her utility of consuming that variety with a factor  $\phi \in (0, 1)$ . The value of  $\phi$  is probably very close to one for headlights and pencils, it is probably lower for a washing machine because of potential differences in the warranty and after sale service and is probably much lower for insurance and architect contracts. There is no discount ( $\phi = 1$ ) if the household has learned the foreign specifications because she then know precisely what she buys. *If the two countries did not agree on mutual recognition*, a household could not consume a foreign variety that has not been adapted to domestic specifications :  $C_l(i) = 0$  for a consumer of  $k$ .<sup>5</sup>

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<sup>5</sup>Equivalently it is as if  $\phi$  was equal to zero.



The earnings of each household are normalized to one. Accordingly, a household in country  $k$  who has not learned foreign specifications demands  $C_k(i) = (p_k(i))^{-\sigma} P_k^{\sigma-1}$  units of a variety that is only designed for domestic specifications; she demands  $C_a(i) = (p_a(i))^{-\sigma} P_k^{\sigma-1}$  units of a variety designed for the specifications of both countries and she demands  $C_l(i) = \Phi (p_l(i))^{-\sigma} P_k^{\sigma-1}$  units of a variety designed only for the specifications of the foreign country. In these expressions,  $p_k(i)$  is the price set by a firm that designs its variety only for country  $k$ , whereas  $p_a(i)$  is the price set by a firm that adapts its variety to the specifications of both countries. The parameter  $\Phi \equiv \phi^{\sigma-1} < 1$  denotes the opposite of the adaptation discount. The lower is  $\Phi$ , the higher is the adaptation discount and the lower is the utility of consuming a product that has not been adapted. Finally,

$$P_k \equiv \left( \int_0^{n_k} (p_k(i))^{1-\sigma} di + \int_{n_k}^{n_k+n_a} (p_a(i))^{1-\sigma} di + \int_{n_k+n_a}^N \Phi (p_l(i))^{1-\sigma} di \right)^{\frac{-1}{\sigma-1}}$$

is the price index for a consumer who has not learned foreign specifications.

A consumer who has learned the foreign specifications behaves as if the degree of harmonization was perfect,  $\Phi = 1$ :  $C_k(i) = (p_k(i))^{-\sigma} P_a^{\sigma-1}$  and  $C_a(i) = (p_a(i))^{-\sigma} P_a^{\sigma-1}$  where

$$P_a \equiv \left( \int_0^{n_k} (p_k(i))^{1-\sigma} di + \int_{n_k}^{n_k+n_a} (p_a(i))^{1-\sigma} di + \int_{n_k+n_a}^N (p_l(i))^{1-\sigma} di \right)^{\frac{-1}{\sigma-1}}$$

is the price index for a consumer who has learned foreign specifications. The price index is lower for someone who has learned foreign specifications ( $P_a < P_k$ ) because she takes the full benefit of more varieties.

Let the variable  $\lambda_k$  denote the proportion of households in country  $k$  who do not learn the foreign specifications. Hence there are four groups of households: on the one hand,  $\lambda_k L_k$  and  $\lambda_l L_l$  households who have not learned the foreign specifications and on the other hand,  $(1 - \lambda_k) L_k$  and  $(1 - \lambda_l) L_l$  households who have learned the foreign specifications.

## 2.2 Firms' behavior

The marginal productivity is normalized to one. A firm in  $k$  that has not adapted its variety to the foreign market earns the following profits:

$$\pi_k(i) = (p_k(i))^{-\sigma} \left( \frac{\lambda_k L_k}{P_k^{1-\sigma}} + \frac{(1-\lambda_r) L_r + (1-\lambda_s) L_s}{P_a^{1-\sigma}} + \Phi \frac{\lambda_l L_l}{P_l^{1-\sigma}} \right) (p_k(i) - 1) - f$$

where  $f$  is the fixed cost of production.

A firm that adapts its varieties earns the following profits

$$\pi_a(i) = (p_a(i))^{-\sigma} \left( \frac{\lambda_r L_r}{P_r^{1-\sigma}} + \frac{(1-\lambda_r) L_r + (1-\lambda_s) L_s}{P_a^{1-\sigma}} + \frac{\lambda_s L_s}{P_s^{1-\sigma}} \right) (p_a(i) - 1) - f - f_a$$

where  $f_a$  is the fixed cost of adapting the variety to the foreign market. The firm sells more to foreign consumers but faces larger fixed costs.

The optimal prices are constant and equal to  $p \equiv p_r(i) = p_a(i) = p_s(i) = \sigma / (\sigma - 1)$ . Thus,

$$P_k \equiv \left( \frac{\sigma}{\sigma - 1} \right) (n_k + n_a + \Phi n_l)^{\frac{-1}{\sigma-1}}, \quad P_a \equiv \left( \frac{\sigma}{\sigma - 1} \right) (n_r + n_a + n_s)^{\frac{-1}{\sigma-1}}$$

Accordingly, profits are

$$\begin{aligned} \pi_k &= \frac{1}{\sigma} \left( \frac{\lambda_k L_k}{n_k + \Phi n_l + n_a} + \frac{(1-\lambda_r) L_r + (1-\lambda_s) L_s}{n_r + n_s + n_a} + \Phi \frac{\lambda_l L_l}{\Phi n_k + n_l + n_a} \right) - f \quad (1) \\ \pi_a &= \frac{1}{\sigma} \left( \frac{\lambda_r L_r}{n_r + \Phi n_s + n_a} + \frac{(1-\lambda_r) L_r + (1-\lambda_s) L_s}{n_r + n_s + n_a} + \frac{\lambda_s L_s}{\Phi n_r + n_s + n_a} \right) - f - f_a \quad (2) \end{aligned}$$

By free entry, profits of active firms must fall to zero.

### 2.3 Learning foreign specifications

We consider two settings. In the first, we assume that households are unable to learn the foreign specifications and we examine firms' behavior. In the second, we allow households to learn foreign specifications. They do learn foreign specifications if learning provides a higher indirect utility. Because all types of firms set the same price,  $p$ , the indirect utility of a consumer from  $k$  who has not learned the foreign specifications is  $W_k$  where

$$pW_k = (n_k + \Phi n_l + n_a)^{\frac{1}{\sigma-1}}, \text{ where } k, l \in \{r, s\} \text{ and } k \neq l.$$

The indirect utility of a consumer who has learned the foreign specifications is  $W_a$  where

$$pW_a = (n_k + n_l + n_a)^{\frac{1}{\sigma-1}} (1 - \Gamma)^{\frac{1}{\sigma-1}}$$

The parameter  $\Gamma$  is a rescaling of the cost of learning foreign specifications, which we assume to be identical for all consumers. We use here a multiplicative cost to simplify notation but all results hold with a linear cost.<sup>6</sup>

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<sup>6</sup>I thank Pierre Picard for this suggestion.

Obviously the assumption of homogeneous consumers implies that within a country, either all households learn the foreign specifications or none of them does it. All consumers in  $k$  learn the foreign specifications if and only if

$$\Gamma < (1 - \Phi) \frac{n_l}{N} \quad (3)$$

Nobody in  $k$  learns the specifications from  $l$  if no firm uses exclusively those specifications, i.e. if  $n_l = 0$ .

Thus, we must consider three configurations: (i) in both countries none of the households learn the foreign specifications,  $\lambda_k = 1$  for all  $k$ ; (ii) in both countries all households learn the foreign specifications,  $\lambda_k = 0$  for all  $k$ ; (iii) all households learn foreign specifications in one country whereas none of them learn these specifications in the other country,  $\lambda_k = 1$  and  $\lambda_l = 0$  for all  $k, l$ .<sup>7</sup>

We now consider the two settings. In the first setting, households cannot learn the foreign specifications whereas in the second setting they may learn these specifications. To ease the notation, we normalize the size of the total population and the total fixed costs to one ( $L_r + L_s = 1$  and  $f + f_a = 1$ ).

### 3 Consumers do not learn

We analyze how firms choose to adapt their specifications in this first setting. Their behavior is guided by their profits (1)-(2) in which we set  $\lambda_k = 1$  for all  $k \in \{r, s\}$ . We use the following bounds:

$$\Phi_1 \equiv \frac{f - L_r}{1 - L_r}, \quad \Phi_2 \equiv 2f - 1, \quad \Phi_3 \equiv \frac{(1 - L_r)f}{1 - L_r f}, \quad \Phi_4 \equiv \frac{1 - L_r}{L_r}.$$

We also consider two levels for the fixed costs: small costs with  $f < 1/(2L_r)$  which implies  $\Phi_1 < \Phi_2 < \Phi_3 < \Phi_4$ ; and large costs with  $f > 1/(2L_r)$ , which implies  $\Phi_1 < \Phi_4 < \Phi_3 < \Phi_2$ .

The comparison of the profits gives the next proposition which is illustrated in Figure 1.

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<sup>7</sup>The expression in (3) could hold with equality, meaning that some households would learn and the other would not learn. Such an equilibrium would not be stable because a small change in the mass of firms would completely change the households behavior.

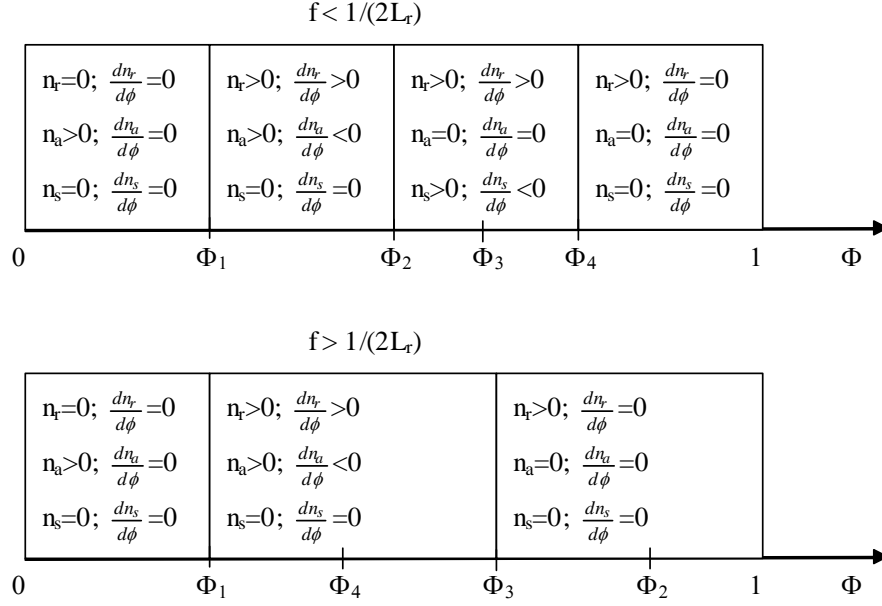


Figure 1: Types of firms as a function of the adaptation discount.

**Proposition 1** *A fall in the adaptation discount induces fewer firms to adapt their product to both countries; it induces more firms to use exclusively the norms of the larger country. If the fixed cost is small enough, it induces fewer firms to use the norms of the smaller country.*

Proof: see the Appendix.

All firms adapt their product to local consumers if the adaptation discount is large, i.e. if  $\Phi \in (0, \Phi_1)$ . Some firms adapt their product to local consumers whereas the other firms use only the specifications of the large country if  $\Phi \in (\Phi_1, \min\{\Phi_2, \Phi_3\})$ . For  $\Phi \in (\min\{\Phi_2, \Phi_3\}, \Phi_4)$ , firms use only the specifications of their home country. Finally, for a small adaptation discount, all firms use only the specifications of the large country.

Consider two countries of different sizes, say Luxembourg and Germany. If they chose to use a single norm, firms prefer the German norm to fully reach the large German market even though they lose some sales on the small Luxembourgish market. The alternative would be to chose the Luxembourgish norm to fully reach the small Luxembourgish market at the cost of losing sales on the large German market. The larger country benefits from a home market effect. Firms choose a single norm only if they do not

lose too many sales on the foreign market, i.e. if the adaptation discount is small enough. Firms prefer to adapt their product to both markets if the adaptation discount is large.<sup>8</sup> For countries of identical sizes,  $\Phi_1 = \Phi_2$  and  $\Phi_4 = 1$ . The top panel of Figure 1 applies ( $f < 1$ ): firms either adapt their product to both markets or they split evenly between the specifications of each country.

To what extent do the two countries have an interest to accept the principle of mutual recognition? To answer this question, we perform a welfare analysis when the principle is accepted by both countries. A firm that exports without having adapted its product to the host country specifications suffers from the consumers adaptation discount. However this firm faces lower fixed costs. From a welfare point of view, two effects have to be taken into account. First consumers lose when buying a good that has not been adapted. Second, more firms may enter the market because of the lower fixed costs if they do not adapt their product. More firms in the market is beneficial to consumers who exhibit a preference for variety.

If the two countries do not agree on mutual recognition, consumers cannot buy non-adapted foreign products; it is as if  $\Phi = 0$ . To check if it is in the interest of a country to accept mutual recognition, it suffices to compare the indirect utility of its consumers when  $\Phi = 0$  (mutual recognition is not accepted) with the indirect utility when  $\Phi > 0$  (mutual recognition is accepted). We find the following proposition which is illustrated in Figure 2 for  $\sigma = 5$ ,  $L_r = .55$ ,  $L_s = .45$ ,  $f_a = .2$ ,  $f = .8$ .<sup>9</sup>

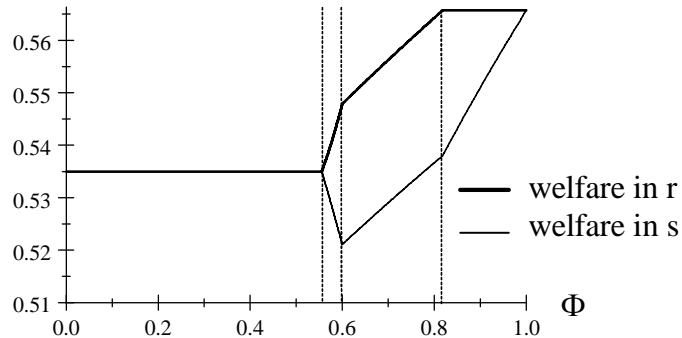


Figure 2: Welfare as a function of the adaptation discount

<sup>8</sup>We suppose that the fixed cost is large enough (equivalently the adaptation cost is small enough) to avoid  $\Phi_1 = (f - L_r) / (1 - L_r) < 0$ . If this condition is not met then there is no equilibrium in which all firms adapt their product to both markets.

<sup>9</sup>Hence,  $\Phi_1 = .556$ ,  $\Phi_2 = .6$ ,  $\Phi_3 = .643$  and  $\Phi_4 = .818$ .

**Proposition 2** *The mutual recognition principle never harms the large country. It is neutral for the small country if the adaptation discount is large; it is detrimental if the adaptation discount takes intermediate values; and it is beneficial if the adaptation discount is small. The mutual recognition principle exacerbates welfare disparities across countries.*

Proof: see the Appendix.

For large adaptation discounts, the adoption of the principle of mutual recognition does not have any effect because firms that adapted their product continue to do it even though the principle is applicable.

For intermediate adaptation discounts some firms in the large country use the principle and cease to adapt their exports, which harms consumers in the small country particularly when the adaptation discount is not negligible. However, more firms enter, which is beneficial for both countries. The larger country unambiguously gains whereas the net effect on the smaller country is negative for intermediate adaptation discount. The principle of mutual recognition creates disparities across countries of different sizes.

For a small adaptation discount the smaller country loses less when it imports non adapted products. Hence, for a sufficiently low value of the adaptation discount, both countries gain because of the increased mass of varieties. Nevertheless, the gain is larger in the large country. Again the principle of mutual recognition creates disparities across countries of different sizes even though both countries gain. It is only in the absence of adaptation discount that both countries have the same benefit from adopting the principle of mutual recognition.

## 4 Consumers may learn

In this setting we assume that households are able to learn foreign specifications. Learning is costly but it allows households to fully benefit from foreign varieties that are not adapted for both countries.

We consider three configurations. First, none of the households learn the foreign specifications. In the previous section we have analyzed the behavior of firms under this configuration. It remains to check for which values of  $\Phi$ , households indeed have no incentive to learn foreign specifications. Second, households from one country learn foreign specifications whereas households from the other country do not learn them. Third, all households from both countries learn foreign specifications.

#### 4.1 No household learn foreign specifications

In the previous section, we have assumed that households do not know foreign specifications. Refusing to learn the foreign specifications is an equilibrium for households in  $k$  if and only if the cost of learning is large enough, i.e., if

$$\Gamma > (1 - \Phi) \frac{n_l}{N} \text{ for households in } k \quad (4)$$

It is clear that for  $n_r \geq n_s$ , households from the small country  $s$  have a larger incentive to learn foreign specifications than households from the large country  $r$  because learning opens full access to a larger set of varieties. Condition (4) is therefore more stringent for households in  $s$  than for households in  $r$ . We establish the following proposition where  $\Phi_a$  and  $\Phi_b$  are defined in the proof of the proposition.

**Proposition 3** *There exists  $\Phi_a$  and  $\Phi_b$  such that households do not learn foreign specifications for  $\Phi \in (0, \Phi_a)$  and for  $\Phi \in (\Phi_b, 1)$ . Such equilibrium does not exist for  $\Phi \in (\Phi_a, \Phi_b)$ .*

Proof: see the Appendix.

On the one hand, if the adaptation discount is large, households do not learn foreign specifications because most firms adapt their product. Households buy few quantities of non-adapted products because of the large adaptation discount. Hence, firms adapt their product to sell more. On the other hand, if the adaptation discount is low, households are not induced to learn the foreign specifications because their adaptation discount is small. The same holds for firms that do not adapt their product because the gain obtained by larger sales is small. Hence, households do not learn foreign specifications and most firms do not adapt their product.

To illustrate, let us take the same parameter values as in Figure 2 and  $\Gamma = 0.2$ . Then  $\Phi_a = 0.604$  and  $\Phi_b = 0.778$ ; For an adaptation discount  $\Phi \in (0.604, 0.778)$  an equilibrium in which households from both countries do not learn foreign specifications does not exist. It exists outside this domain.

#### 4.2 Households from one country learn the foreign specifications

Let all households from country  $l$  learn the foreign specifications whereas those living in country  $k$  do not. Hence the specifications of country  $k$  are known by all households and it is not necessary for firms to adapt their

product to the specifications of country  $l$ . By contrast, it is profitable for firms to use specifications of country  $k$  in order to fully reach households from that country. Hence,  $n_a = n_l = 0$  and  $n_k > 0$ . To solve the model analytically, it suffices to plug  $\lambda_k = 1$ ,  $\lambda_l = 0$  in (1)-(2). It is then confirmed that  $\pi_k > \pi_a$  and  $\pi_k > \pi_l$ . Moreover  $\pi_k = 0$  requires  $n_k = 1/(\sigma f)$ .

Consider now the households behavior. Households from  $k$  do not learn specifications from  $l$  because none of the firms use these specifications. To what extent do households from  $l$  learn specifications from  $k$ ? They learn these specifications if and only if the learning costs is small enough, i.e., from (3), if and only if  $\Gamma < 1 - \Phi$ . Equivalently, they learn foreign specifications if and only if the adaptation cost is large enough, i.e.,  $\Phi < 1 - \Gamma$ . This gives the next proposition.

**Proposition 4** *For  $\Phi < 1 - \Gamma$ , there exists an equilibrium in which (1) households from a first country do not learn foreign specifications, (2) households from the second country learn the foreign specifications, (3) all firms adopt the specifications of the first country.*

The proposition does not predict which specifications are adopted by firms. It may be the specifications of the large or of the small country. Moreover, the proposition also applies to *two countries of identical sizes*: all firms use the specifications of a single country if the costs of learning foreign specifications are small and if the adaptation discount is large ( $\Phi < 1 - \Gamma$ ). Mutual recognition creates disparities. On the one hand, firms do not adapt their product to the foreign market because foreign households have learned the home specifications. On the other hand foreign households learn these specifications because these are the sole specifications that are used and because the gain of learning is high whereas the cost is low.

Let us now turn to the welfare analysis of this situation. Because firms do not adapt their product, more firms enter the market. In country  $k$ , households benefit from a large number of varieties that fit with their specifications. The households in country  $l$  also fully benefit from this large number of varieties because they have learned the foreign specifications. However they suffer from the costs of learning foreign specifications. We find the following Proposition.

**Proposition 5** *Suppose that all firms chose the specifications of country  $k$  and all households from  $l$  learn the specifications of  $k$ . Households from  $k$  unambiguously gain from the application of the principle of mutual recognition. Households from the other country gain only if the cost of learning foreign specifications is small ( $\Gamma < 1 - f$ ).*



Proof: see the Appendix.

From a global point of view it is preferable that country  $l$  be the small country, i.e. that the smallest number of households pay the costs of learning the foreign specifications.

### 4.3 Households from both countries learn foreign specifications

The firms do not need to adapt their product if households from both countries learn foreign specifications. Moreover the firms are indifferent between both specifications. Consider a small perturbation of that equilibrium: a small mass of households from country  $k$  have not learned foreign specifications. Then firms strictly prefer the specifications of country  $k$  in order to fully reach these deviating households. Hence, the other households in  $k$  do not need to learn foreign specifications because firms do not use the  $l$  specifications. The initial perturbation in which some households in  $k$  do not learn is self-reinforcing and the equilibrium is not stable. For this reason we do not analyze this configuration further.

### 4.4 Multiplicity of equilibria

There exists a “no-learning” equilibrium in which households do not learn in two cases: if  $\Phi < \Phi_a$  and if  $\Phi > \Phi_b$ . There is also a “learning equilibrium” in which households from only one country learn foreign specifications if  $\Phi < 1 - \Gamma$ . From the proof of Proposition 3, we know that  $\Phi_b \leq 1 - \Gamma$ . Hence there is an equilibrium for all values of the adaptation discount. Moreover, there is a multiplicity of equilibria for low values of the adaptation discount ( $\Phi < \Phi_a$ ) and, possibly, for intermediate values of the discount ( $\Phi \in (\Phi_b, 1 - \Gamma)$ ).

We now compare these equilibria from a welfare point of view.

**Proposition 6** *Suppose that in the “learning equilibrium”, households in country  $l$  learn the foreign specifications. Households in country  $k$  always prefer the “learning equilibrium”. Households in country  $l$  prefer the “no-learning” equilibrium if the learning cost is large, or if the adaptation discount is small and  $l$  is the large country.*

In the learning equilibrium, firms never adapt their product, which reduces the fixed costs compared to the no-learning equilibrium. Hence, more firms enter and all households benefit from more varieties. Households in  $k$  do not pay the learning costs and benefit from more varieties; they thus prefer the learning equilibrium. Households in  $l$  pay the learning costs. They

prefer the learning equilibrium only if the learning cost is small enough. Moreover, if country  $l$  is the large country and if the adaptation discount is small, households in  $l = r$  unambiguously prefer the no-learning equilibrium which ensures them that all firms use the norms of their own country.

## 5 Conclusion

The principle of mutual recognition ensures that products lawfully manufactured in one State are acceptable without adaptation in another State provided that both States pursue the same general objectives in health, safety, environment and consumer protection. By using the principle of mutual recognition firms save the costs of adapting their product to local norms. As a result more firms are able to enter into the market. However the principle of mutual recognition shifts the transaction costs of adapting to several norms from firms to consumers. Consumers suffer either from consuming a good that is not perfectly adapted, or from learning foreign norms.

In a first setting we consider consumers who do not learn foreign norms. Everything else equal, firms prefer the norms of the larger market, because these norms are known by the majority of consumers. However, if the adaptation discount is large, some firms will also use the norms of the smaller market. There is a home market effect: the norms of the larger country are overly used by firms. The principle of mutual recognition is unambiguously welfare improving in the larger market but is welfare improving in the smaller market only if consumers do not suffer too much from consuming a non adapted product. The principle of mutual recognition is a source of divergence.

In a second setting, we assume that consumers can learn the foreign norms, which removes the costs of consuming a product that is not adapted to the local norms. We show that for intermediate and for large adaptation discounts, there exists an equilibrium in which households from one country learn the foreign norms whereas all firms use these norms that become universally known. Households who learn the foreign norms are worse off than households from the other country. The principle of mutual recognition fosters the use of a single norm. We also show that for small and for large adaptation discounts, there exists an equilibrium in which households do not learn the foreign specifications. Firms adapt their product only if the loss is large and there is a multiplicity of equilibria. We compare the welfare properties of these equilibria.

## 6 Appendix

### 6.1 Proof of Proposition 1

We first show that the three types of firms cannot be active simultaneously. Second we establish the condition under which all types of firms adapt their specifications to both countries. Third, we derive the conditions for the coexistence of firms that have adapted their product to both specifications with firms that use the specification of only one country; moreover we show that this must be firms using the large country specifications. Fourth, we compute the conditions for the coexistence of firms that use the specifications of the large country with firms that use the other specifications. Finally we show that for a small adaptation discount all firms use the specifications of the large country.

We set  $\lambda_k = 1$  for all  $k \in \{r, s\}$  in the profits (1) and (2). By free entry, all firms must earn zero profit. A type of firms that is expected to entail losses is not chosen by firms.

1. There does not exist an equilibrium with three types of firms ( $n_r > 0$ ,  $n_s > 0$ ,  $n_a > 0$ ). Indeed setting the profits equal to zero for the three types of firms creates a system of three equations with the following two ‘unknowns’,  $L_r / (n_r + \Phi n_s + n_a)$  and  $L_s / (\Phi n_r + n_s + n_a)$ , which does not have any solution.

2. An equilibrium where all firms adapt their product ( $n_r = n_s = 0$ ,  $n_a > 0$ ) requires  $\pi_a = 0$  and  $\pi_r, \pi_s < 0$ . Using (1)-(2), it is readily checked that  $\pi_a = 0 \iff n_a = 1/\sigma$ . The condition  $\pi_s < 0$  is less stringent than the condition  $\pi_r < 0$ , which requires  $\Phi < \Phi_1$ .

3. An equilibrium where some firms adapt to the specifications of both countries and the other firms stick to the rules of the small country ( $n_r = 0$ ,  $n_s > 0$ ,  $n_a > 0$ ) is not feasible because it is easily checked that  $\pi_s \leq \pi_r$  if  $n_r = 0$ , which is incompatible with  $n_s > 0$ .

An equilibrium where some firms adapt to the specifications of both countries and the other firms stick to the rules of the large country ( $n_r > 0$ ,  $n_s = 0$ ,  $n_a > 0$ ) requires  $\pi_r = \pi_a = 0$ ,  $\pi_s < 0$ . Using (1)-(2), it is readily checked that  $\pi_r = \pi_a = 0$  require

$$n_r = \frac{L_r(1 - \Phi) - (f - \Phi)}{\sigma(1 - f)(f - \Phi)} \text{ and } n_a = \frac{-fL_r(1 - \Phi) + (f - \Phi)}{\sigma(1 - f)(f - \Phi)}$$

which are positive if and only if  $\Phi_1 < \Phi < \Phi_3$ . Finally  $\pi_s < 0 \iff \Phi < \Phi_2$ . Hence, this equilibrium requires  $\Phi_1 < \Phi < \min\{\Phi_2, \Phi_3\}$  where  $\min\{\Phi_2, \Phi_3\} = \Phi_2 \iff f < 1/(2L_r)$ .

4. An equilibrium where no firm adapts and where each country hosts firms that have adopted the local rules ( $n_r > 0$ ,  $n_s > 0$ ,  $n_a = 0$ ) requires  $\pi_r = \pi_s = 0$  and  $\pi_a < 0$ . Using (1)-(2), it is readily checked that  $\pi_r = \pi_s = 0$  require

$$n_r = \frac{L_r - \Phi(1 - L_r)}{f\sigma(1 - \Phi)} > n_s = \frac{1 - L_r - L_r\Phi}{f\sigma(1 - \Phi)}$$

which are positive if and only if  $\Phi < \Phi_4$ . Finally,  $\pi_a < 0 \iff \Phi > \Phi_2$ . Thus this equilibrium requires  $\Phi_2 < \Phi < \Phi_4$  where  $\Phi_4 > \Phi_2 \iff f < 1/(2L_r)$ .

5. An equilibrium where all firms use the local rules of the large country ( $n_r > 0$ ,  $n_s = 0$ ,  $n_a = 0$ ) requires  $\pi_r = 0$ ,  $\pi_s < 0$ ,  $\pi_a < 0$ . Using (1)-(2), it is readily checked that  $\pi_r = 0 \iff n_r = 1/(\sigma f)$ . Moreover,  $\pi_s < 0 \iff \Phi > \Phi_4$  and  $\pi_a < 0 \iff \Phi > \Phi_3$ .

Note that the complementary equilibrium in which all firms would adopt the local rules of the small country would require  $\Phi > L_r/(1 - L_r)$  which is not possible under the assumption that  $r$  is the large country.

## 6.2 Proof of Proposition 2

To ease notation, we rescale the indirect utility  $W$  as  $V \equiv \sigma^\sigma (W/(\sigma - 1))^{\sigma-1}$ . If the two countries do not agree on mutual recognition, firms adapt their product for the export market ( $n_a = 1/\sigma$ ) and both countries reach the same level of indirect utility,  $V_{ini}$  where

$$V_{ini} \equiv 1 \tag{5}$$

Figure 1 identifies four possible equilibria under the principle of mutual recognition. We consider them successively.

First, for  $\Phi \leq \Phi_1$ , all firms adapt their product ( $n_a = 1/\sigma$ ). It is as if the principle of mutual recognition was not used:  $V_r = V_s = V_{ini}$ :

Second, for  $\Phi \in (\Phi_1, \min\{\Phi_2, \Phi_3\})$ , some firms adapt their product and the other firms follow the rules of the larger country. Then

$$V_r = L_r \frac{1 - \Phi}{f - \Phi}, V_s = (1 - L_r) \frac{1 - \Phi}{1 - f} \tag{6}$$

It is readily checked that households in  $r$  gain:  $V_r \geq V_{ini}$  for  $\Phi \geq \Phi_1$ , with equality at  $\Phi = \Phi_1$ . This gain increases with  $\Phi$  because more goods are then produced. By contrast, the opposite holds for households in  $s$ ,  $V_s \leq V_{ini}$ . Despite the larger number of goods available when the adaptation discount decreases, the consumers losses in  $s$  increase with  $\Phi$  because fewer goods are adapted to their country.

Third, for  $\Phi \in (\Phi_2, \Phi_4)$ <sup>10</sup> firms are active in each country and they do not adapt their product for the export. Welfare are then

$$V_r = L_r \frac{1 + \Phi}{f}, V_s = (1 - L_r) \frac{1 + \Phi}{f} \quad (7)$$

Again, households from  $r$  unambiguously gain ( $V_r > V_{ini}$ ) and the gain increases with the value of  $\Phi$ . For low values of  $\Phi$ , households from  $s$  lose compared to the initial situation ( $V_s < V_{ini}$ ). Nevertheless, their loss decreases with  $\Phi$  and may vanish for a sufficiently large value of  $\Phi$ .

Finally, for  $\Phi \in (\min\{\Phi_3, \Phi_4\}, 1)$  firms stick to the rules of the larger country. Because the adaptation discount is small, the small country does not lose much; it even gains because of the larger mass of varieties available. Welfare is

$$V_r = \frac{1}{f}, V_s = \frac{\Phi}{f} \quad (8)$$

Households in  $r$  gain compared to the initial situation but their gain is now independent of  $\Phi$ . Households in  $s$  may lose for low values of  $\Phi$  but they gain for values of  $\Phi$  that are larger than  $f$ .

### 6.3 Proof of Proposition 3

First consider  $\Phi \in (0, \Phi_1)$ . According to Figure 1, all firms adapt their product,  $n_r = n_s = 0$ ,  $n_a > 0$ . Clearly all goods are available at local specifications meaning that households from both countries do not need to learn the foreign specifications. This is confirmed by (4) which is always fulfilled at  $n_r = n_s = 0$ . Hence, there exists an equilibrium in which households do not learn the foreign specifications and all firms adapt their product if  $\Phi \in (0, \Phi_1)$ .

Second consider  $\Phi \in (\Phi_1, \min\{\Phi_2, \Phi_3\})$ . Firms that adapt their product coexist with firms that use only the specifications of the large country,  $n_s = 0$ ,  $n_a, n_r > 0$ . We plug the value of  $n_r$  and  $n_a$  found in the proof of Proposition 1 in (4) to show that the households from  $s$  do not learn the  $r$ -specifications if and only if

$$\Phi < \Phi_a \equiv \Phi_1 + \Gamma(1 - f) \frac{L_r}{1 - L_r}$$

Hence, there exists an equilibrium in which households do not learn the foreign specifications and firms either adapt their product or use exclusively the

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<sup>10</sup>If  $f > 1/(2L_r)$ .

norm of the large country ( $n_a, n_r > 0, n_s = 0$ ) if  $\Phi \in (\Phi_1, \min \{\Phi_a, \Phi_2, \Phi_3\})$ .

Third, consider  $\Phi \in (\Phi_2, \Phi_4)$  (and thus,  $\Phi_3 < \Phi_4$ ; this is the top panel of Figure 1). Some firms use exclusively the norm of the large country and the other firms use the norm of the small country,  $n_r, n_s > 0, n_a = 0$ . We plug the value of  $n_r$  and  $n_s$  found in the proof of Proposition 1 in (4) to show that the households from  $s$  do not learn the  $r$ -specifications if and only if

$$\Phi > \Phi'_b \equiv \frac{L_r - \Gamma}{1 - L_r}$$

Hence, there exists an equilibrium in which households do not learn the foreign specifications and firms either use exclusively the norm of the large country or the norm of the small country ( $n_r, n_s > 0, n_a = 0$ ) if  $\Phi \in (\max \{\Phi_2, \Phi'_b\}, \Phi_4)$ . This interval could be empty.

Fourth, consider  $\Phi \in (\max \{\Phi_3, \Phi_4\}, 1)$ . All firms use exclusively the norm of the large country  $r$ ,  $n_r > 0, n_s = n_a = 0$ . From (4), households from  $s$  do not learn foreign specifications if and only if  $\Gamma > 1 - \Phi$ , i.e., if and only if

$$\Phi > \Phi''_b \equiv 1 - \Gamma$$

Hence, there exists an equilibrium in which households do not learn the foreign specifications and firms use exclusively the norm of the large country ( $n_r > 0, n_s = n_a = 0$ ) if  $\Phi \in (\max \{\Phi_3, \Phi_4, \Phi''_b\}, 1)$ . This interval is never empty.

It is readily checked that

$$\Phi'_b < \Phi_4 \iff \Phi'_b < \Phi''_b \iff \Phi''_b < \Phi_4$$

Hence, we can summarize the third and fourth points with the following statement. Let  $\Phi_b$  be the minimum of  $\Phi'_b$  and  $\Phi''_b$  if  $\Phi_4 > \Phi_3$  (top panel of Figure 1) and  $\Phi_b$  be  $\Phi''_b$  if  $\Phi_4 < \Phi_3$  (bottom panel of Figure 1). Then there exists an equilibrium in which households do not learn the foreign specifications if  $\Phi \in (\Phi_b, 1)$ .

To sum up, an equilibrium in which households do not learn foreign specifications exists for  $\Phi < \Phi_a$  and  $\Phi > \Phi_b$ . It does not exist if  $\Phi_a < \Phi < \Phi_b$ .

## 6.4 Proof of Proposition 5

If the two countries do not agree on mutual recognition, firms adapt their product for the export market ( $n_a = 1/\sigma$ ) and both countries reach the

same level of welfare,  $V_{ini}$  given in (5). If all firms choose the specifications of country  $k$  and households from  $l$  learn these specifications,  $n_k = 1/(\sigma f) > 1/\sigma$  and welfare levels in both countries are given by

$$V_k = \frac{1}{f} \text{ and } V_l = \frac{1 - \Gamma}{f} \text{ where } k \in \{r, s\} \text{ and } k \neq l \quad (9)$$

Country  $k$  unambiguously gains by adopting the principle of mutual recognition. Households in country  $l$  gain if the costs of learning is low ( $\Gamma < 1 - f$ ) but they lose otherwise.

## 6.5 Proof of Proposition 6

In the learning equilibrium,  $n_l = n_a = 0$ ,  $n_k = 1/(\sigma f)$  and the indirect utility of households in  $k$  is  $V_k = (1/f)$  whereas it is  $V_a = (1 - \Gamma)/f$  for households in  $l$ .

Consider now the equilibrium in which households do not learn. Let us start with  $\Phi < \Phi_1$ . Thus,  $n_r = n_s = 0$  and  $n_a = 1/\sigma$  and the indirect utility of households is  $V_r = V_s = V_{ini} = 1$ . Households in  $k$  unambiguously prefer that households learn in  $l$  whereas the households in  $l$  prefer the equilibrium with learning only if the learning cost is small enough (i.e., only if  $\Gamma < 1 - f$ ).

Second, consider  $\Phi \in (\Phi_1, \min\{\Phi_2, \Phi_3\})$ . The indirect utility of households is given in (6). Households in  $k$  unambiguously prefer that households learn in  $l$  because  $1/f$  is larger than the two expressions in (6) for any  $\Phi < \Phi_3$ . Households in  $l$  also prefer the equilibrium with learning only if the learning cost is small enough.

Third, consider  $\Phi \in (\min\{\Phi_2, \Phi_3\}, \Phi_4)$ . The indirect utility of households is given in (7). Households in  $k$  unambiguously prefer that households learn in  $l$  because  $1/f$  is larger than the two expressions in (7) for any  $\Phi < \Phi_4$ . Households in  $l$  also prefer the equilibrium with learning only if the learning cost is small enough.

Fourth, consider  $\Phi > \max\{\Phi_3, \Phi_4\}$ . The indirect utility of households is given in (8). Households in  $k$  prefer that households learn in  $l$  (with indifference if  $k$  is the large country). Households in  $l$  prefer the no learning equilibrium if  $l$  is the large country. Otherwise, they prefer the learning equilibrium only if the cost of learning is small enough.

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